Mojave Desert
Air Quality Management District

Technical Report

Health & Safety Code §39614
Feasibility Analysis for
Composting and Related Operations

October 22, 2007

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TECHNICAL REPORT
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Abbreviations

ASP	Aerated Static Pile
ATCM	Airborne Toxic Control Measure
BACT	Best Available Control Technology
BARCT	Best Available Retrofit Control Technology
CARB	California Air Resources Board
CCAA	California Clean Air Act
FCAA	Federal Clean Air Act
HAP	Hazardous Air Pollutant
H_2S	Hydrogen Sulfide
MACT	Maximum Achievable Control Technology
MDAQMD	Mojave Desert Air Quality Management District
NESHAP	National Emissions Standard for Hazardous Air Pollutant
NH_3	Ammonia
NO_x	Oxides of Nitrogen
NSPS	New Source Performance Standard
NSR	New Source Review
O_3	Ozone
PM	Particulate Matter
$PM_{2.5}$	Fine Particulate Matter
PM_{10}	Coarse Particulate Matter (Respirable)
ppmv	Parts Per Million by Volume
RACT	Reasonably Available Control Technology
RTO	Regenerative Thermal Oxidizer
SCAQMD	South Coast Air Quality Management District
SJVAPCD	San Joaquin Air Pollution Control District
SO_x	Oxides of Sulfur
SWCAA	South West Clean Air Agency
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compounds

I. EXECUTIVE SUMMARY

California H&S Code §39614 requires the Mojave Desert Air Quality Management District (MDAQMD) to ensure that all feasible particulate control measures are in place. The MDAQMD currently has no control measures in place for composting or composting-related operations. The California Air Resources Board (CARB) has identified several composting and composting-related control measures as potentially feasible. This document evaluates the feasibility of applying those composting and composting-related control measures within the MDAQMD, using a cost-effectiveness basis to define feasible.

Best management practices for composting and composting-related operations are determined to be cost-effective and hence feasible within the MDAQMD regardless of facility size or throughput. Add-on control technology for composting and composting-related operations is determined to not be cost effective and hence not feasible within the MDAQMD at this time (at a minimum cost effectiveness of $4,912 per ton of particulate precursor reduced). Add-on control technology for composting and composting-related operations is determined to be feasible within the MDAQMD contingent upon a federal fine particulate standard non-attainment designation. MDAQMD staff recommends the adoption of a best management practices rule for composting and composting-related operations that includes the add-on control technology requirement as a contingency measure.

II. INTRODUCTION

This Technical Report is an analysis of the costs and cost-effectiveness for composting and related operations. This analysis is being made in response to the mandate of H&S Code §39614(d) and the subsequent CARB document *Proposed List of Measures to Reduce Particulate Matter – PM_{10} and $PM_{2.5}$*. The recommendations in this report are based upon a cost effectiveness threshold of less than $4,912 per ton of particulate precursor volatile organic compounds (VOC) and $8,424 per ton of particulate precursor ammonia (NH_3). These cost effectiveness values now define a feasibility threshold for all subsequent particulate control feasibility analyses; all future analyses with cost effectiveness at or above these levels will also not be feasible.

A. California Law

In 2003, the Legislature enacted H&S Code §39614 (SB 656, Sher), to reduce public exposure to PM_{10} and $PM_{2.5}$. H&S Code §39614 requires the CARB in consultation with local air pollution control and air quality management districts (air districts), to develop and adopt, by January 1, 2005, a list of the most readily available, feasible, and cost-effective control measures that could be employed by CARB and the air districts to reduce PM_{10} and $PM_{2.5}$ (collectively PM). The list of proposed control measures was to be based on rules, regulations, and programs existing in California as of January 1, 2004. H&S Code §39614 also requires that by July 31, 2005, air districts to adopt implementation schedules for appropriate measures. Finally, by no later than January 1, 2009, CARB must prepare a report describing actions taken to fulfill the requirements of the legislation as well as recommendations for further actions to assist in achieving the State PM standards. H&S Code §39614 sunsets on January 1, 2011, unless extended.

On November 18, 2004, CARB adopted *Proposed List of Measures to Reduce Particulate Matter – PM_{10} and $PM_{2.5}$* to satisfy the initial requirements of H&S Code §39614. The CARB adopted document contains a table entitled "SB 656 List of Air District Measures that Reduce Particulate Matter" (Local PM Measures List). H&S Code §39614(d) requires the MDAQMD to adopt an analysis schedule to determine the feasibility of local measures from this list.

The *List and Implementation for District Measures to Reduce PM Pursuant to Health & Safety Code §39614(d)* was prepared by the MDAQMD to meet the requirements of H&S Code §39614(d) by analyzing each control measure on the Local PM Measures List and placing each into one of four categories. The first category includes measures that are already being implemented by the MDAQMD in its rules and programs. The second category lists measures that do not need to be implemented within the MDAQMD because there are no sources of that type currently located within the District and any new sources would be required to install Best Available Control Technology (BACT) pursuant to the MDAQMD's New Source Review (NSR) regulations. A third category includes those measures that are included or could be included in rules scheduled for adoption or modification in the near future. The final category lists those measures that require additional cost-effectiveness analysis to determine if such rules are feasible to implement within the MDAQMD. The composting and related operations analysis falls into this final category.

The MDAQMD initially proposed to evaluate the CARB measures regarding Composting and Related Operations by August 25, 2008. At the request of the Governing Board April 23, 2007 this evaluation was expedited to be completed by August 27, 2007. District staff has prepared this technical report entitled *Health & Safety Code §39614 Feasibility Analysis for Composting and Related Operations* to satisfy the analysis commitment for the composing source category contained in the PM Implementation Schedule and the request of the MDAQMD Governing Board.

In support of this analysis, staff visited composting facilities both within and outside of the District. Staff reviewed United States Environmental Protection Agency (USEPA) fact sheets and environmental impact reports pertaining to composting as well as regulations adopted by the South Coast Air Quality Management District (SCAQMD) and the San Joaquin Unified Air Pollution Control District (SJUAPCD). Staff reviewed all potential air quality related impacts of composting, including emission of volatile organic compounds (VOC), ammonia (NH_3), particulate matter (PM), pathogens and bioaerosols.

Resources utilized in the preparation of the technical discussion included:

- Document review of relevant publications (See bibliography, Appendix B).

- Site visits to Inland Empire Regional Composting Facility (06/04/07), One Stop Landscape Supply Center (06/08/07), California Biomass and Victor Valley Wastewater Reclamation Authority (May and October, 2007).

- Meetings with Nursery Products: 05/02/07 to invite input of current, relevant documents relating to costs and emission factors (only information received on 08/07/07 was for general costs of new Synagro facility in Kern County); 07/03/07 to discuss Nursery Products generated document; 08/03/07 to receive comment on the MDAQMD technical discussion regarding disputed costs and emission factors used in report (no changes made); 08/31/07 to request review of documents pertaining to concerns raised by public comment at the August Governing Board meeting.

- Meetings with members of the community.

B. Legal Regulation of Composing Operations within the MDAQMD

Local air districts such as the MDAQMD have primary authority over the control of pollution from non-vehicular sources of air pollution (H&S Code §§39002, 40000). H&S Code 40001 requires local air districts to adopt rules and regulations to implement and enforce applicable provisions of the Federal Clean Air Act (FCAA) and the California Clean Air Act (CCAA). These requirements are also subject to legislatively created limitations found not only in the Health & Safety Code but also in other State and Federal statutes.

In general the Governing Board of the MDAQMD adopts rules and regulations to provide control measures for non-vehicular sources of air pollution while the Air Pollution Control Officer issues permits to implement and enforce such rules (See H&S Code §§40750 et seq.). The level of control required under the FCAA and CCAA in the rules is based upon the severity of the pollution problem in a particular region. The MDAQMD's nonattainment status for the various criteria air pollutants is shown in Table 1.

Table 1 - MDAQMD Nonattainment Statuses

Pollutant	*Federal Non-Attainment Status*	*State Non-Attainment Status*
Ozone (O_3)	Moderate/Unclassified (8hr standard) Severe 17/Unclassified (Prior 1 hr standard)	Moderate
Coarse Particulate (PM_{10})	Nonattainment - Moderate	Nonattainment
Fine Particulate ($PM_{2.5}$)	Attainment/Unclassified	Nonattainment/Unclassified
Hydrogen Sulfide (H_2S)	N/A (not a federal criteria pollutant)	Nonattainment – Searles Valley only.

Under the FCAA the MDAQMD as a moderate ozone nonattainment area (8-hour standard) and as a former Severe-17 ozone nonattainment area (1-hour standard) is required to impose Reasonably Available Control Technology Limits (RACT) on Federal Major Sources of VOC and NO_x (FCAA §182(a)(2)(A). It is also required to impose BACT limits on new or modified Federal Major Sources and offset those new sources at a ratio of 1.3 lbs for each 1 lb of VOC or NO_x proposed to be emitted (FCAA §182(d)(2)). As a PM_{10} moderate nonattainment area the MDAQMD is required to impose RACT on Federal Major Sources of PM (FCAA §189(a)(1)(C)). The size of facility designated a Federal Major Source of pollution also varies dependant upon the severity of the pollution in an area. For the MDAQMD a Federal Major

Source is a stationary unit that emits or has the potential to emit the following pollutants or their precursors in the amounts shown in Table 2 below.

Table 2 - MDAQMD Major Source Thresholds	
Pollutant	*Amount*
VOC (ozone and particulate precursor)	25 tons per year
NO_x (ozone and particulate precursor)	25 tons per year
Any single Hazardous Air Pollutant (HAP)	10 tons per year
Any combination of HAPs	25 tons per year
Any other criteria pollutant	100 tons per year

In addition, the FCAA requires the MDAQMD to implement and impose the requirements from various other Federal programs on all sources subject to those programs within its jurisdiction. These programs include but are not limited to New Source Performance Standards (NSPS), National Emissions Standards for Hazardous Air Pollutants (NESHAPS), and Maximum Achievable Control Technology Standards for Hazardous Air Pollutants (MACT).

Under the CCAA the MDAQMD as a moderate nonattainment area for ozone is required to impose RACT upon existing non-vehicular sources of air pollution emitting or having the potential to emit greater than 25 tons per year of any state non-attainment pollutant (H&S Code §40918(a)(1)). For those existing sources of a state non-attainment pollutant emitting greater than 250 tons per year the MDAQMD is required to impose Best Available Retrofit Control Technology (BARCT) (H&S Code §40918(a)(2)). In addition H&S Code §40918(a)(1) also requires any new or modified non-vehicular emissions unit with the potential to emit over 25 pounds per day to be equipped with BACT. Furthermore, the MDAQMD is required to provide a NSR program that is designed to achieve no net increase in emissions of nonattainment pollutants or its precursors (H&S Code §40918(a)(1)). Similar to the Federal law the CCAA also requires the MDAQMD to implement and impose other state mandated programs. These include but are not limited to State Airborne Toxic Control Measures (ATCMs), the Air Toxic "Hot Spots" Program and other direct legislative requirements such as those contained in H&S Code §39614.

The MDAQMD has the following rules and regulations directly applicable to composting operations: Rule 402 - *Nuisance* and Rule 403 - *Fugitive Dust*. MDAQMD Regulation XIII - *New Source Review* would only apply to new or modified facilities greater than the Federal Major Source threshold and new emissions units with a potential to emit greater than 25 lbs of a nonattainment pollutant a day. There is currently no source specific RACT rule for composting operations due to the fact that none of the existing composting operations within the MDAQMD emit or have the potential to emit greater than the Federal Major Source threshold. There are currently no NSPS, NESHAP, MACT or ATCM standards applicable to composting operations.

Given the current regulatory framework and non-attainment status designations the MDAQMD has the legal authority to impose some additional regulations on the category of composting operations. The MDAQMD may develop and impose a RACT rule on such operations pursuant to the Federal and State requirements for RACT on Federal Major Sources of VOC, NOx and PM (FCAA §182(a)(2)(A) and 189(a)(1)(C); H&S Code 40918(a)). Pursuant to the provision of

H&S Code 39614(d) the MDAQMD is required to adopt and implement control measures for PM_{10} and $PM_{2.5}$ that are cost-effective local measures. Since RACT is, by definition, based upon cost effectiveness any control measure for PM_{10} and $PM_{2.5}$ developed and implemented under that provision would be required to be RACT equivalent.

The legal authority of the MDAQMD to impose BACT upon any new or modified composting operation is completely dependant on the potential to emit of the proposed new or modified facility pursuant to Regulation XIII. Potential to emit for a facility is calculated by adding the potential to emit for all new and existing which already have or will require permits to fugitive emissions of HAPS and any other fugitive emissions if the facility happens to be one of the 27 source categories listed in 40 CFR 51.165(a)(1)(iv)(C). Composting operations are not one of those 27 source categories. Potential to emit for this source category does not include vehicular emissions including but not limited to loaders, scrapers, tractors, delivery haul trucks etc. It also does not include emissions from non-point or stack sources of pollution such as piles of finished or unfinished product. Therefore, unless the permitted equipment has a potential to emit greater than the major source threshold as set forth in Rule 1303(B) NSR will not mandate BACT upon the entire facility. However, certain emissions units such as grinders, crushers, conveyor belts and the engines that drive them may require BACT on a unit by unit basis pursuant to the provisions of MDAQMD Rule 1303(A)(1).

III. TECHNICAL DISCUSSION

A. SOURCE DESCRIPTION

Composting is one of several methods for treating putrescible materials such as biosolids (wastewater sludge), manure, food waste, and green waste ("feedstock") to create a marketable end product that is easy to handle, store, and use. The end product is a humus-like material that can be applied as a soil conditioner and fertilizer to gardens, food and feed crops, and rangelands. This compost provides large quantities of organic matter and nutrients (such as nitrogen and potassium) to the soil, improves soil texture, and elevates soil cation exchange capacity (an indication of the soil's ability to hold nutrients), all characteristics of a good organic fertilizer. Compost derived from these materials is safe to use and generally has a high degree of acceptability by the public. Thus, it competes well with other bulk and bagged products available to homeowners, landscapers, farmers, and ranchers[1].

There are three commonly used methods of composting. Each method involves mixing the feedstock with a bulking agent to provide carbon and increase porosity. The resulting mixture is piled in windrows (long rows) or placed in a vessel where microbial activity causes the temperature of the mixture to rise during the "active composting" period. The specific temperatures that must be achieved and maintained for successful composting vary based on the method and use of the end product. After active composting, the material is cured and distributed. The three commonly employed composting methods are described in the following

[1] United States Environmental Protection Agency, *Biosolids Technology Fact Sheet, Use of Composting for Biosolids Management,* EPA 832-F-02-024, September 2002, pg.1.

paragraphs. A fourth method (static pile) is not recommended for composting these materials based on a lack of operational control[2].

- Aerated Static Pile (ASP) – Feedstock is mechanically mixed with a bulking agent and stacked into long piles over a bed of pipes through which air is transferred to the composting material. After active composting, as the pile is starting to cool down, the material is moved into a curing pile[3].

- Windrow – Feedstock is mixed with bulking agent and piled in long rows. Because there is no piping to supply air to the piles, they are mechanically turned to increase the amount of oxygen. This periodic mixing is essential to move outer surfaces of material inward so they are subjected to the higher temperatures deeper in the pile. A number of turning devices are available, including: (1) drums and belts powered by agricultural equipment and pushed or pulled through the composting pile; (2) self-propelled models that straddle the composting pile; and (3) off road equipment. As with aerated static pile composting, the material is moved into curing piles after active composting. Several rows may be combined into a larger pile for curing[4].

- In-Vessel – A mixture of feedstock and bulking agent is fed into a silo, tunnel, channel, or vessel. Augers, conveyors, rams, or other devices are used to aerate, mix, and move the product through the vessel to the discharge point. Air is generally blown into the mixture. After active composting, the finished product is usually stored in a pile for additional curing prior to distribution. An ASP composting operation conducted within a building vented to a control device may also be considered "In-Vessel" composting[5].

All three composting methods require the use of bulking agents, but the type of agent varies. Wood chips and saw dust are commonly used, but many other materials are suitable.

Because composting operations differ widely based on the type of material processed, the ambient weather, the site geography, the site throughput, and other factors, it is very difficult to compare composting facilities.

1. Applicability

Several facilities in the MDAQMD have operations potentially affected by this analysis. These facilities include the Victor Valley Regional Composting Facility, the Fort Irwin National Training Center Composting Facility, the proposed Nursery Products Co-Composting facility, and sanitary landfills that accept biosolids.

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[2] Ibid, pg. 1.
[3] Ibid, pg. 2.
[4] Ibid, pg. 2.
[5] United States Environmental Protection Agency, *Biosolids Technology Fact Sheet, In-Vessel Composting of Biosolids,* EPA 832-F-00-061, September 2000, pg.1.

2. Rule History

The MDAQMD does not have a composting rule at this time. This Feasibility Analysis has evaluated the measures referenced by H & S Code §39614 to determine if their requirements are cost-effective and to what extent they may be implemented within the MDAQMD.

B. EMISSIONS

Following is a brief description of the health and environmental concerns with air contaminants emitted from composting and related operations that contribute to the formation of ozone and particulate matter (PM).

For emissions purposes, it is assumed that the active phase of the composting cycle takes approximately 22 days, with the resulting product being cured for at least 30 additional days before use. The active composting phase of the process is the time period where organic material decomposes at its fastest rate and emissions are generated at a high rate. The compost may be considered cured or stable by the oxygen uptake rate, a low degree of reheating in curing piles, the organic content of the compost, and the presence of nitrates and the absence of NH_3 and starch in the compost. An accepted method for determining the maturity of compost is the Solvita Maturity Index.

Based on the 22-day assumption, for VOC, 80 percent of the emissions are released during the active phase and 20 percent of emissions are released during the curing phase of the process. For NH_3, 50 percent of the emissions are released during the active phase, and 50 percent of emissions are released during the curing phase of the process[6]. The Emission Inventory Improvement Program (EIIP), *Estimating Ammonia Emissions from Anthropogenic Nonagricultural Sources, Draft Final Report* (April 2004) assigns the recommended emission factors for composting operations which compost a mixture of biosolids and green waste (50:50 mixture by weight) as 3.12 lb/ton for VOCs and 2.81 lb/ton for NH_3. These values are presented in Table 3[7]. The use of a green waste composting factor results in conservatively high emissions (by a factor of 3 or more) for the composting sector, as not all composting operations accept green waste. Increasing emissions has the effect of reducing (improving) the cost-effectiveness of control technology by increasing the emissions controlled. An applicable PM emissions factor for co-composting and related operations was not available.

Table 3 - Emission Factors for Biosolids Composting

	Total Process	*Active Composting*	*Curing*
VOC Emission Rate (lb/ton)	3.12	2.50	0.62
NH_3 Emission Factor (lb/ton)	2.81	1.40	1.40

6 South Coast Air Quality Management District, *Technology Assessment for Proposed Rule 1133,* March 2002, pg. 2-4.

7 Emissions Inventory Improvement Program, *Estimating Ammonia Emissions From Anthropogenic Nonagricultural Sources – Draft Final Report,* April 2004, pg. 21.

1. VOC

VOCs are produced during the anaerobic (in the absence of oxygen) decomposition of organic material. Decomposition occurs when chipped and ground material is composted or when the material is left in an unmanaged state and begins to rot.

There are no state or national ambient air quality standards for VOCs because they are not classified as criteria pollutants. VOCs are regulated, however, because they contribute to the formation of ozone and are transformed into organic aerosols in the atmosphere, contributing to higher PM_{10} and lower visibility levels. Ozone is formed in the atmosphere through a photochemical reaction of VOC and NO_x.

Ozone is a deep lung irritant, causing the lung passages to become inflamed and swollen. Exposure to ozone produces alterations in respiration, the most characteristic of which is shallow, rapid breathing and a decrease in pulmonary performance. Ozone reduces the respiratory system's ability to fight infection and to remove foreign particles. People who suffer from respiratory diseases such as asthma, emphysema, and chronic bronchitis are more sensitive to ozone's effects. Early studies suggested that long-term exposure to ozone results in adverse effects on morphology and function of the lung and acceleration of lung-tumor formation and aging. Ozone exposure also increases the sensitivity of the lung to broncho-constrictive agents such as histamine, acetylcholine, and allergens.

The MDAQMD has been designated non-attainment for state and federal ozone standards, making VOCs a regulated pollutant throughout the MDAQMD.

2. Ammonia

Composting and related operations (i.e., chipping and grinding) are a source of NH_3, which is a precursor to $PM_{2.5}$. NH_3 in the atmosphere reacts with nitric acid and sulfuric acid to produce nitrate and sulfate particles, a constituent of $PM_{2.5}$. NH_3 is generated during biological degradation (or decomposition) of organic materials (i.e., yard waste, manure, sewer sludge, etc.) that occurs during composting and when chipped and ground material begins to rot. NH_3 is produced in both aerobic (in the presence of oxygen) and anaerobic (in the absence of oxygen) environments. Composting is an aerobic process but can become anaerobic when for example, a pile is built incorrectly, the pile gets too little oxygen, the temperature is too high, or there is too little or too much moisture. Chipped and ground material that is left unmanaged likewise begins to decompose and produce NH_3 emissions for the same reasons as composting.

The MDAQMD has been designated attainment/unclassified for the Federal $PM_{2.5}$ standard, and non-attainment for the State $PM_{2.5}$ standard. There are no NH_3 ambient air quality standards. In the absence of state planning requirements for $PM_{2.5}$, the $PM_{2.5}$ precursor NH_3 is not a regulated pollutant within the MDAQMD.

3. Particulate Matter

Composting and related operations are sources of fugitive PM_{10}.

PM_{10} is a public health concern since particles less than 10 microns can be deposited in, and can damage, the airways of the lower respiratory tract and the gas-exchange portions of the lung. The adverse health effects of particulates, especially PM_{10}, are well documented. Various health studies have linked PM_{10} emissions to increased respiratory infections, more severe asthma, declines in pulmonary function, and shortened life spans. Specifically, recent studies indicate that the current ambient levels of PM_{10} (30 to 150 $\mu g/m^3$) experienced in many different communities in the United States are associated with increases in daily cardio-respiratory mortality and in total mortality, excluding accidental and suicide deaths. Increases in ambient PM_{10} levels have also been shown to result in increases in acute respiratory hospital admissions, school absences in children, and increases in the use of medications in children and adults with asthma.[8]

PM_{10} is generated when composting materials are unloaded, when piles are turned, moved, from wind entrainment of static uncovered piles, and screening of finished compost. Associated activities like chipping and grinding also produces PM_{10} emissions when the wood and green waste are mechanically ground and shredded. PM_{10} is also generated from periodic grading, onsite equipment operations, fugitive dust from haul trucks and employee commute trips.

Windblown dust from windrows has been suggested as one of the main contributors to the overall emissions from a composting facility. According to a report prepared by the County of Los Angeles Department of Health Services there are two reasons this is not the case[9]. The first is that the compost material is very moist and not a candidate for wind erosion. Secondly, a crust appears to form on the surface of the windrows that is created by the sludge, which has a consistency similar to glue, which also makes the windrows resistant to wind erosion.

There were no specific PM emission factors located for composting windrows. However, commonly accepted emission factor sources, such as USEPA's AP-42, contain many emission factors for fugitive sources, including grading, vehicle trips on paved and unpaved roads, and bulk material handling.

4. Pathogens and Bioaerosols

a. Pathogens

Sewage sludge may contain a wide variety of pathogenic (or disease causing) bacteria, viruses, protozoans, and helminths (roundworms and tapeworms). Exposure to pathogens is assumed to occur through direct contact (direct ingestion or adsorption through a cut or exposed wound), inhalation, or by vectors (flies, mosquitos, fleas, or rodents). The concern over any particular pathogen that may be present in biosolids is related to its ability to infect a host and cause disease. This ability depends on a wide variety of environmental factors (e.g., ability to survive

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[8] South Coast AQMD, *Technology Assessment for Proposed Rule 1133* (March 2002), pg. 1-2.
[9] County of Los Angeles Department of Health Services, *Public Health Issues Regarding Proposed Wheelabrator Clean Water Systems (Bio Gro) Sewage Sludge Composting Facility* (January 11, 1997), pg. 6.

wastewater treatment, longevity in the environment) and host-specific factors (sanitary habits, overall health, and any immune system impairments).

> *The greatest direct exposure to biosolids is experienced by wastewater treatment plant operators and biosolids management facilities operating personnel. The greatest possible health risk associated with direct contact would probably involve a person having a cut or an exposed wound coming in direct contact with biosolids or contaminated operating equipment as the result of an unusual incident such as a fall or accident. Studies of the incidence of disease among wastewater personnel have indicated that they have no greater incidence of disease than the population in general (Clark et al. 1980, Cooper 1991). Farmers who have worked biosolids-amended soils have direct contact with biosolids and can get biosolids on their clothing. Studies have also been performed to compare the health of farm families from those farms using biosolids with the health of families on farms not using biosolids, and no health differences have been found (Dorn et al. 1985).*[10]
>
> *Dust and fine particles that can be inhaled and reach the deepest parts of the lung are of particular health concern. Measurements of bacteria in the air downwind of biosolids processing or application sites is limited (Pillai et al. 1996) and the data collected shows the presence of high numbers of bacteria when there is mixing or dispersal (like a manure spreader), but the risk of an infectious dose of a pathogenic bacterial species in an outdoor area appears to be negligible (Pillai et al. 1996). No reported cases of bacterial or viral illness derived from such an occurrence were found during the literature review including the work of Pillai et al. (1996). Studies of composting operations and at farms where biosolids have been used show no unusual health effects compared to farms where no biosolids were applied (Dorn et al. 1985). Those at risk in the areas immediately adjacent to such operations are immunosuppressed people such as organ transplant recipients, and people with cancer, AIDS, or leukemia (Rosenberg and Minimato 1996, Ampel 1996). Such operations have been regulated such that setbacks and restrictions on dust generation have been placed on them by the California Integrated Waste Management Board.*[11]

No reported cases of air-borne transmission of disease have been documented in California as it relates to biosolids management although the potential exists.

Transport of bacteria, viruses and other pathogens by air or by aerial vectors such as insects and birds has been hypothesized, but there is no substantiation in researched literature to support this as a method of disease transmission from biosolids operations.

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[10] California State Water Resources Control Board, *General Waste Discharge Requirements for Biosolids Land Application*, Draft Statewide Program EIR (February 2004), pg. 5-19.
[11] California State Water Resources Control Board, *General Waste Discharge Requirements for Biosolids Land Application*, Draft Statewide Program EIR (February 2004), pg. 5-21.

b. Bioaerosols

Bioaerosols (organisms or biological agents in air that affect human health) are a concern in compost emissions. The most widely studied bioaerosol is *Aspergillus fumigatus (A. fumigatus),* a fungal spore. Endotoxins (non-living components of cell walls of gram negative bacteria) and organic dust (such as pollens) are also bioaerosols. Studies have shown that *A. fumigatus* is ubiquitous in the environment, meaning it is everywhere. *A. fumigatus* thrives in the environment created during composting. These fungi are found everywhere where the right conditions exist (compost piles, wood chip piles, potted plants), not just in biosolids operations. Biofilters used to control odors from the composting facility can themselves give off the same bioaerosols generated during the composting process. The organism is generally considered a secondary pathogen, adversely affecting the infirmed or immune compromised individual. Although this fungus spore is generated in large quantities in compost, the numbers of spores usually do not measure above normal background levels at distances of more that 250-500 feet from the composting site according to a report prepared by the County of Los Angeles Department of Health Services.[12]

These contaminants would be primarily of concern to workers at composting facilities and are generally not present in quantities that would cause reactions in most humans. Health effects to compost facility workers have not been readily apparent in studies conducted to identify such effects (Epstein *et al*., 1998.). According to a technical bulletin from the California Integrated Waste Management Board titled "*Aspergillus, Aspergillosis, and Composting Operations in California*",[13]

> *One should recognize that composting facilities do represent sites where there is a massive culturing of Aspergillus fumigatus organisms in relatively small areas compared to most "natural" or background circumstances. Thus, without dust control, there is an elevated risk of exposure to spores for workers at compost facilities. In a worst-case scenario, a respiratory model developed by Boutin et al. (1987) estimated that a completely unprotected worker shoveling mature compost at a highly contaminated site could inhale 25,000 to 30,000 viable spores per hour. However, elevated exposure is not automatically synonymous with an elevated health risk for compost workers (or neighboring communities). Epstein (1993) discusses several composting facilities in the USA in which health monitoring (physical exams) of compost workers has been conducted; the results of the physical exams did not reveal any illnesses directly associated with composting. As discussed in Section 6, dust exposures at composting facilities are <u>readily controllable</u>, and control benefits and protects both facility workers and nearby residences.*
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> *However, many public health specialists, scientists, and engineers in North America and Europe believe that properly operated composting and co-composting operations present little health risk to normal compost facility*

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[12] County of Los Angeles Department of Health Services, *Public Health Issues Regarding Proposed Wheelabrator Clean Water Systems (Bio Gro) Sewage Sludge Composting Facility* (January 11, 1997), pg. 3.
[13] California Integrated Waste Management Board, *Aspergillus, Aspergillosis, and Composting Operations in California* (December 16, 1993), pg. 10.

employees, and negligible if any risk for nearby residences (Millner et al. 1977, Clark et al. 1983, Epstein and Epstein 1985, Boutin and Moline 1987, Maritato et al. 1992). Diaz et al. (1992) stated:

The existence of hazard from the spores of A. fumigatus [at commercial composting facilities] is yet to be demonstrated. The infectivity of the spores is low. Consequently, any danger posed by it would be of significance only to the unusually susceptible individual. Nevertheless, prudence indicates that an open-air compost plant should not be sited in close proximity to human habitations.

There have only been a few reported cases of biosolids-related illnesses as a result of the fungus *Aspergillus fumigatus*. There have been reported cases of fungal allergies and possible outbreaks of asthma near composting operations.[14]

5. Odors

Composting operations produce odors. Odors generated by the biosolids treatment process may be perceived as unhealthy due to the origin of the solids. Odors may also decrease public support for biosolids recycling programs. As biosolids degrade, the most offensive odorous compounds formed are organic and inorganic forms of sulfur, NH_3, amines, organic fatty acids, and hydrocarbons. Odors will vary depending on the type of residual solids processed and the method of processing. The main factors affecting the generation of odor are identified as: the proper mixing of the feedstock (bulking agent and biosolids), the choice of feedstock, prevention of anaerobic conditions within the compost pile and the prevention of liquid ponding at the facility. Odors have not been shown to cause illness.

C. BASIS FOR CO-COMPOSTING ANALYSIS

This analysis examines the cost-effectiveness of three South Coast Air Quality Management District (SCAQMD) Rules as required by H&S Code §39614 to reduce public exposure to PM_{10} and $PM_{2.5}$. These rules were determined to be a list of the most readily available, feasible, and cost-effective control measures that could be employed by CARB and the air districts to reduce PM_{10} and $PM_{2.5}$ (collectively PM). Appendix B of the *Proposed List of Measures to Reduce Particulate Matter*, Strategy E – *Composting and Related Operations* (Measures reduce ammonia and VOC) items 54, 55, and 56, refer to these three SCAQMD rules which were adopted on January 10, 2003: Rule 1133 – *Composting and Related Operations – General Administrative Requirements,* Rule 1133.1 – *Chipping and Grinding,* and Rule 1133.2 – *Emission Reductions From Co-Composting Operations*.

The San Joaquin Valley Air Pollution Control District (SJVAPCD) also adopted Rule 4565 – *Biosolids, Animal Manure, and Poultry Litter Operations* on March 15, 2007, which is pertinent to this feasibility analysis. While this rule was adopted subsequent to the ARB list, it represents similar, suitable levels of control as imposed by the SCAQMD rule and was therefore considered as an additional reference.

[14] California State Water Resources Control Board, *General Waste Discharge Requirements for Biosolids Land Application*, Draft Statewide Program EIR (February 2004), Chapter 5.

The Southwest Clean Air Agency (SWCAA), which is responsible for enforcing federal, state, and local air quality standards in southwest Washington State, permitted the Little Hanaford Farms Composting Facility and identified several general process controls. While this determination was also not referenced by the ARB list, it identifies controls imposed by the SJVAPCD rule and was therefore considered as an additional reference. Similar control measures were also referenced in the SCAQMD Technology Assessment for Rule 1133, but not used as a basis for specific emission reductions.

The following rule requirements were analyzed to determine their feasibility for composting and related operations in the MDAQMD:

1. SCAQMD Rule 1133 – *Composting and Related Operations – General Administrative Requirements*

This rule sets forth administrative requirements for existing and new chipping and grinding activities and composting operations. The purpose of this rule is to create an emissions-related informational database on composting and related operations through a registration process. Requirements include:

a. New and existing operators of chipping and grinding activities and composting operations must register with the SCAQMD and update this registration on a yearly basis.

b. Operators subject to registration requirements subject to one-time registration fee equivalent to plan submittal fee in accordance with SCAQMD Rule 306 at time of registration.

c. Exempt facilities and operations include: portable chipping and grinding; community composting; agricultural composting; nursery composting; recreational facilities composting; backyard composting; and wood waste chipping and grinding facilities.

There are limited composting or related operations within the MDAQMD. These facilities already have specific equipment on site requiring air permits. A separate registration process would be a cumbersome and redundant requirement for handful of affected facilities. A cost-effective solution would be to require equivalent administrative requirements as part of a composting operation permit.

2. SCAQMD Rule 1133.1 – *Chipping and Grinding Activities*

The purpose of this rule is to prevent the inadvertent decomposition occurring during chipping and grinding activities. Requirements of SCAQMD Rule 403 – *Fugitive Dust* also apply to these activities. Requirements include:

a. Time requirements for removal, processing, or on-site use of these items: food waste; curbside green waste; non-curbside green waste; mixed green waste; and the chipped or ground waste generated by the operator; and

b. Maintain records of registration and updates required by SCAQMD Rule 1133, and specified operational parameters; and

c. Measure moisture content of chipped and ground green waste.

d. Exemptions include: chipped and ground green waste (not food waste) derived from the site and used on-site; portable, agricultural, land clearing, wood waste, and palm chipping and grinding; and chipped and ground green waste are exempt from holding time requirement if moisture content is less than 30 percent.

These holding and processing times are in line with normal management practices and should be cost-effective for all facilities, regardless of size. Optimization of these parameters helps to create a good composting product as well as giving an air quality benefit.

3. SCAQMD Rule 1133.2 – *Emission Reductions From Co-Composting Operations*

The Technology Assessment for Rule 1133.2 evaluated three control scenarios for co-composting:

a. Scenario 1

    i. Enclosure of the active and curing phase of the process and the utilization of ASP; and,
    ii. Venting of emissions to a control device (biofilter).

b. Scenario 2

    i. Enclosure of the active phase of the process and the utilization of ASP; and
    ii. Utilization of a ASP system under negative pressure for the curing phase of the process (no enclosure); and
    iii. Venting of emissions to a control device (biofilter).

c. Scenario 3

    i. Utilization of a ASP system under negative pressure for the active and curing phase of the process (no enclosure); and
    ii. Venting of emissions to a control device (biofilter).

The SCAQMD determined that scenario 2 was cost-effective for new co-composting facilities. The purpose of Rule 1133.2 is to reduce VOCs and NH_3 from new and existing co-composting operations. Existing co-composting facilities are to submit a compliance plan demonstrating an overall reduction of 70 percent by weight for VOC and NH_3 emissions. Acceptable control measures for existing operations include but are not limited to: enclosure; aeration; biofiltration; scrubber; process controls and best management practices. SCAQMD also listed optimal composting conditions (see Table 4).

Table 4 - Optimal Composting Conditions	
Characteristic	*Preferred Range*
Carbon:Nitrogen ratio	25:1 to 40:1
Moisture content	50% to 60%
Oxygen concentration	5% to 15%
pH	6.5 to 8.0
Temperature	130°F to 150°F

Requirements of Rule 1133.2 include:

a. New co-composting operations shall conduct all active co-composting within an enclosure meeting various structural and operational parameters; and

b. Conduct all curing operations using an aeration system under negative pressure for no less than 90 percent of its blower(s) operating cycle; and

c. Vent exhaust from the enclosure and aeration system to an emissions control system designed with a control efficiency equal or greater than 80 percent, by weight, for VOC and NH_3 emissions; or

d. Submit a compliance plan demonstrating an overall emission reduction of 80 percent, by weight, for VOC and NH_3 emissions from baseline emission factors.

e. Existing co-composting operations shall submit a compliance plan demonstrating an overall emission reduction of 70 percent, by weight, for VOC and NH_3 emissions from baseline emission factors.

f. Baseline emission factors shall be 1.78 pounds of VOC per ton of throughput and 2.93 pounds of NH_3 per ton of throughput.

g. Demonstrate control efficiency of emissions control system by a source test for new and existing co-composting operations on an initial basis and every two years thereafter.

h. If operating under a compliance plan, provide certification of compliance report on an initial basis and every two years thereafter to demonstrate compliance with emission reductions.

i. Exemptions include:

    i. Agricultural, green waste, wood waste, and co-composting operations with a design capacity of less than 1,000 tons of throughput per year;
    ii. Existing co-composting operations with a design capacity of 35,000 ton of throughput per year containing no more than 20 percent biosolids, by volume;
    iii. Use an aeration system vented to an emission control device with a control efficiency of 80 percent, by weight, for VOC and NH_3 emissions; and are owned and operated by a municipality which composts waste generated within the

jurisdiction of the municipality; and process less than 5,000 tons of biosolids or manure per year, combined.

The MDAQMD has evaluated the cost-effectiveness of Rule 1133.2 measures individually in section (D).

4. SJVAPCD Rule 4565 – *Biosolids, Animal Manure, and Poultry Litter Operations*

The purpose of this rule is to limit emissions of VOCs from operations involving the management of biosolids, animal manure, or poultry litter. The rule applies to all facilities whose throughput consists entirely or in part of biosolids, animal manure, or poultry litter and the operator who landfills, land applies, composts, or co-composts these materials. Requirements include:

a. Landfill Requirements

i. Biosolids, animal manure, or poultry litter received at a landfill shall be covered within 24 hours with approved material. Biosolids or biosolids-derived materials shall not be used as an alternative daily cover unless prior approval is received.
ii. In lieu of covering the biosolids, animal manure, or poultry litter, an operator may implement an alternative mitigation measure that demonstrates at least a 10 percent reduction in VOC emissions.

b. Land Application Requirements

An operator that land-applies material containing biosolids, animal manure, or poultry litter shall implement at least one of the following mitigation measures:

i. Directly inject the material at least three inches below the soil surface within three hours of receipt at the facility; or
ii. Land incorporate the material within three hours of receipt at the facility. If received after 6:00 pm, must be incorporated by noon of the following calendar day; or
iii. Cover the material within three hours of receipt at the facility with six inches of finished compost, soil, or a waterproof cover. When conditions are appropriate, must be directly injected or land incorporated within three hours of uncovering the material; or
iv. Implement an alternative mitigation measure(s) not listed demonstrating at least a 10 percent reduction in VOC emissions.

c. Composting/Co-composting Facility Requirements. See Table 5.

i. Throughputs less than 20,000 wet tons per year shall: Implement at least three Class One mitigation measures; or Implement at least two Class One mitigation measures in addition to one Class Two mitigation measure for active composting.
ii. Throughputs of at least 20,000 wet tons per year but less than 100,000 wet tons per year shall: Implement at least four Class One mitigation measures; or

Implement at least three Class One mitigation measures in addition to one Class Two mitigation measure for active composting.

iii. Throughputs of at least 100,000 wet tons per year shall: Implement at least four Class One mitigation measures and one Class Two mitigation measure for active composting; or Implement at least two Class One mitigation measures in addition to one Class Two mitigation measure for active composting and one Class Two mitigation measure for curing composting. ASP composting operations shall have no measurable increase (<0.45 ppmv increase) over background levels of hydrocarbons within three feet of any surface of the ASP.

iv. In-vessel composting operations shall have no measurable increase (<0.45 ppmv increase) over background levels of hydrocarbons outside the in-vessel enclosure, including any opening that occurs for access or maintenance.

Table 5 - Composting/Co-composting Facility Mitigation Measures	
Class One Mitigation Measures	
1.	Scrape or sweep, at least once a day, all areas where compostable material is mixed, screened, or stored such that no compostable material greater than one inch (1") in height is visible in the areas scraped or swept immediately after scraping or sweeping, except for compostable material in process piles or storage piles.
2.	Maintain a minimum oxygen concentration of at least five percent (5%), by volume, in the free air space of every active and curing compost pile.
3.	Maintain the moisture content of every active and curing compost pile between 40% and 70%, by weight.
4.	Manage every active pile such that the initial carbon to nitrogen ratio of every pile is at least twenty (20) to one (1).
5.	Cover all active compost piles within 3 hours of each turning with one of the following: a waterproof covering; at least six (6) inches of finished compost; or at least six (6) inches of soil.
6.	Cover all curing compost piles within 3 hours of each turning with one of the following: a waterproof covering; at least six (6) inches of finished compost; or at least six (6) inches of soil.
7.	Implement an alternative Class One mitigation measure(s) not listed above that demonstrates at least a 10% reduction, by weight, in VOC emissions.
Class Two Mitigation Measures	
8.	Conduct all active composting in aerated static pile(s) vented to a VOC emission control device with a VOC control efficiency of at least 80% by weight.
9.	Conduct all active composting in an in-vessel composting system vented to a VOC emission control device with a VOC control efficiency of at least 80% by weight.
10	Conduct all curing composting in aerated static pile(s) vented to a VOC emission control device with a VOC control efficiency of at least 80% by weight.
11	Conduct all curing composting in an in-vessel composting system vented to a VOC emission control device with a VOC control efficiency of at least 80% by weight.
12.	Implement an alternative Class Two mitigation measure(s) not listed above that demonstrates at least 80% reduction, by weight, in VOC emissions.

The holding and processing times for landfill requirements, land application requirements, and class one mitigation measures are in line with normal management practices and should be cost-effective for all facilities, regardless of size.

SJVAPCD claims an overall 10 percent reduction in emissions for facilities with a throughput between 100 and 20,000 tpy (implement three Class I mitigation measures) and an overall 20 percent reduction in emissions for facilities with a throughput between 20,000 and 100,000 tpy (implement four Class I mitigation measures). The MDAQMD has been unable to justify the quantification of these emission reductions, but agrees that good composting management practices will produce an air quality benefit.

The cost-effectiveness of individual class two mitigation measures is presented in section (D).

5. SWCAA *Little Hanaford Farms Technical Support Document*

The SWCAA determined the following process controls for composting parameters to be:

a. Maintaining moisture content below 70 percent by weight (preferably between 50 percent and 60 percent); and

b. Maintaining at least 5 percent O_2 in the free air space, preferably 10 percent by volume; and

c. Maintaining incoming feedstocks for a C:N ratio of at least 20:1, preferably 30:1; and

d. Adequately mixing the incoming feedstocks so the moisture and nutrients, including C:N are maintained in the proper proportions in all parts of the composting mass; and

e. Maintaining the pH below 7.0 to avoid loss of NH_3 as ammonium hydroxide.

These process controls are in line with normal management practices and should be cost-effective for all facilities, regardless of size. Optimization of these parameters helps to create a good composting product as well as giving an air quality benefit.

D. FEASIBILITY OF OPTIONS

The following emission control technology or methods were identified by the MDAQMD as composting processes from least control to most control and analyzed for cost-effectiveness. Due to a dearth of cost data for historical and potential control applications, the District is using control cost numbers of questionable accuracy from a variety of inconsistent sources (please refer to the bibliography in Appendix B). As discussed above, the District is also using a conservatively high emissions assumption for composting (using the green waste emissions factor). As a result, District staff considers the following cost-effectiveness analyses extremely conservative.

Windrows, or uncontrolled composting in long narrow piles exposed to the elements, is used as the uncontrolled baseline for this analysis.

1. General Process Controls (Best Management Practices) Scenario

General process controls optimize process parameters to minimize the generation of gaseous emissions (SJVAPCD Class I Mitigation Measures, Little Hanaford Farms composting parameters, SCAQMD controls). Employment of best management practices was found to be cost-effective independent of facility size/throughput. Because composting operations vary so widely based on the feedstock, weather, site geography, throughput and other factors, it is very difficult to compare control technology between different facilities (or quantify reductions). However, all composting processes and technologies should operate so that they optimize certain parameters. Optimizations of these parameters help create a good composting product and are expected to give an air quality benefit. In its analysis, SCAQMD states that "good practices for compost mixing, curing and storage can also reduce odors, dust and emissions; however, the amount of reductions cannot be easily quantified". The following general process controls represent best management practices for composting operations:

a. Scrape or sweep, at least once a day, all areas where compostable material is mixed, screened, or stored such that no compostable material greater than one inch (1") in height is visible in the areas scraped or swept immediately after scraping or sweeping, except for compostable material in process piles or storage piles; and

b. Maintain initial carbon to nitrogen ratio in range of 20:1 to 40:1 in active piles; and

c. Maintain moisture content between 50 percent to 60 percent in active and curing piles; and

d. Maintain oxygen concentration between 5 percent to 15 percent in free air space of active and curing piles; and

e. Maintain pH between 6.5 to 8.0 in active and curing piles; and

f. Adequately mix incoming feedstock so that moisture and nutrients are maintained in proper proportions in all parts of the composting piles.

g. Cover active piles within three hours of turning with one of the following: a waterproof covering; at least six inches of finished compost; or at least six inches of soil.

h. Cover curing piles within three hours of turning with one of the following: a waterproof covering; at least six inches of finished compost; or at least six inches of soil.

i. Maintain daily records of materials receipt, discharge, and operational activities sufficient to verify the above.

2. Un-enclosed ASP and Biofilter Scenario

ASP technology collects 25 percent of VOC emissions and 19 percent of NH_3 emissions. A biofilter then removes 90 percent of those VOCs collected, and 75 percent of the NH_3 collected.

3. Enclosed ASP/In-Vessel and Regenerative Thermal Oxidizer (RTO) Scenario

An enclosure of both the active and curing phase will capture 95 percent of the VOC and NH_3 emissions. A RTO then removes 95-99 percent of those VOCs and NH_3 collected.

4. Enclosed ASP/In-Vessel and Biofilter Scenario

An enclosure of the active and curing phase will capture 95 percent of the VOC and NH_3 emissions. A biofilter then removes 90 percent of those VOCs collected, and 75 percent of the NH_3 collected.

The MDAQMD calculated the average cost-effectiveness for each add-on control option by determining the difference in dollar costs between the add-on control and the no-control baseline divided by the emission reduction potential of the add-on control.

H & S Code §40920.6 requires the MDAQMD to calculate the incremental cost-effectiveness for potential control options prior to adopting rules or regulations. Incremental cost-effectiveness is determined by calculating the difference in dollar costs divided by the difference in the emission reduction potentials between each progressively more stringent potential control option as compared to the next less expensive control option.

Best management practices while being the lowest level, unquantifiable emission reduction strategy was not analyzed for cost-effectiveness but rather was determined to be cost-effective regardless of facility size or throughput. Scenarios 2-4 above require significant capital, operating and maintenance costs. An un-enclosed ASP and Biofilter (active and curing) had the lowest cost of add-on control technology analyzed for cost-effectiveness. The next control option considered for cost-effectiveness was enclosed ASP/In-Vessel and biofilter (active and curing). The highest level of control considered was Enclosed ASP/In-Vessel and Regenerative Thermal Oxidizer (RTO). Table 6 compares the cost-effectiveness range for the three levels of control for a normalized facility with a 400,000 wet ton per year throughput. The MDAQMD has determined that control scenarios 2 through 4 above, requiring the use of forced draft ventilation systems and associated air pollution control equipment with a minimum cost-effectiveness of $4,912 per ton of PM precursor VOC are not cost-effective or feasible.

Table 6 - Cost Effectiveness
(dollars per ton reduced, annualized)

Add-on Control Technology	*Average* VOC	*Average* NH_3	*Incremental* VOC	*Incremental* NH_3
Unenclosed ASP vented to biofilter	4,912	8,611	n/a	n/a
Enclosed ASP vented to RTO	7,587	8,424	8,475	8,389
Enclosed ASP vented to biofilter	9,474	12,623	(26,386)	(7,324)

F. Other Issues

1. Livestock Manure

At last estimation in the mid-1990s, the MDAQMD contained 18,000 head of dairy cattle producing 84 tons per year of VOC, and 14,000 head of beef cattle producing 27 tons per year of VOC. The dairy and feedlot manure producing these estimated emissions are currently land-applied to alfalfa hay fields for livestock feed. These emissions are uncontrolled, and the manure receives none of the processing that reduces harmful bacteria in biosolids.

2. Land Application

Currently, biosolids are being land applied in Newberry Springs. San Bernardino County ordinance requires anyone landspreading sludge to first obtaining a permit and approval from Environmental Health Services (EHS). EHS will only issue permits for property that is actively being or is going to be farmed. Only class A sludge is permitted to be landspread.

Riverside County prohibits land application of Class B sewage sludge in unincorporated county areas[15]. Ordinance 812 found "there are unanswered questions about the safety, environmental effects, and propriety of land application of sewage sludge, even when the sludge is applied in accordance with federal, state and local regulations. Sludge contains heavy metals, pathogenic organisms, chemical pollutants, and synthetic organic compounds, which may pose an unknown degree of risk to public health and the environment. There currently is a lack of adequate scientific understanding concerning the risk that land application of sludge may pose to soils, air, water and to human and plant and animal health. In addition, such application may cause loss of confidence in agricultural products from Riverside County as well as the potential loss of use of productive agricultural lands. Therefore, with the degree of uncertainty that exists in terms of risk, the continuation of the practice of the land application of sewage sludge may unnecessarily jeopardize the public and the environment. In order to adequately protect the public health and the safety and welfare of Riverside County and its residents, it is the intent of this chapter that the land application of sewage sludge shall be prohibited in the unincorporated area of Riverside County".

Class B biosolids may have low levels of pathogens which rapidly die-off when applied to soils, essentially becoming pathogen-free within a short period following application when the "Part 503" Rule requirements are followed. "Part 503" refers to the section in Title 40 of the Code of Federal Regulations, where various standards related to pathogens and metals in biosolids are codified. Class A biosolids are essentially free of pathogens prior to land application. The metal contents requirements under the Part 503 Rule are the same for Class A and Class B biosolids. Exceptional Quality biosolids have lower metals concentration requirements than either Class A or Class B biosolids and have the same pathogen levels as Class A biosolids[16].

3. Septage at Landfills

An undetermined amount of septage is discharged into surface evaporation ponds at sanitary landfills located within the MDAQMD, typically from septic system evacuations. None of this material receives elevated temperature processing to reduce harmful bacteria concentrations.

The Barstow Sanitary Landfill (BSL) is one of several landfills that accepts septage. According to the Final Environmental Impact Report for the Barstow Sanitary Landfill Expansion Project (July 2007), there are two lined surface impoundments located west of the existing refuse area. The lined surface impoundments have the capacity (design volume) to handle a total of 3.85 million gallons of liquid septage. Liquid waste, including grease trap/car wash wastes, consists

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[15] Riverside County Ordinance Number 812 - *Prohibition Of Land Application Of Class B Sewage Sludge*, Adopted 07/10/2001.

[16] California Integrated Waste Management Board, Biosolids Home Page, www.ciwmb.ca.gov/Organics/Biosolids.

of all liquid designated wastes that are not chemically incompatible with the liner material. The lined surface impoundments have a leachate collection and removal system (LCRS) in-place. The leachate collection sumps are monitored regularly in accordance with the site's Septage Management Plan.

The land farm is a 6.5-acre area located west of the lined surface impoundments. The land farm is surrounded by earthen berms constructed around the perimeter to control stormwater flows. The land farm is used for septage waste aeration purposes only. Once waste from the surface impoundments dries to greater than 50 percent solids, the waste is removed from the ponds and then spread within 4.1 acres of the 6.5-acre land farm. Tilling of the material is performed over a two-week period to assist in additional drying of the material. The material is tested until the analytical results are below thresholds set by the RWQCB prior to being disposed of in the working face of the BSL or an alternative Class III disposal facility. The land farm area is monitored regularly in accordance with the site's Septage Management Plan.

IV. STAFF RECOMMENDATION

MDAQMD staff recommends the adoption of a best management practices rule for composting and composting-related operations that includes the add-on control technology requirement as a contingency measure. The add-on control technology requirement would be triggered by a non-attainment designation of the MDAQMD for the federal $PM_{2.5}$ ambient air quality standard by the USEPA.

The recommended rule would be applicable to all composting and composting-related operations, and would require compliance with the best management practices presented in subsection D(1) above from all composting-related operations. The contingency requirement would require an enclosure venting to an RTO from any composting operation handling at least 100,000 wet tons per year.

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Appendix “A”

Calculations and Assumptions for Determining Cost-Effectiveness

	Uncontrolled	Control 1	Control 2	Control 3
	Windrow	Unenclosed ASP to biofilter	Enclosure venting to RTO	Enclosure to biofilter
Operational Days	365	365	365	365
Project Term (years)	15	15	15	15
Sample Project Throughput (wet tons/year)	*547500*	*547500*	*547500*	*547500*
Sample Project Capital Cost (1998 $)	*$ 6,305,000*	*$ 16,170,000*	*$ 67,423,850*	*$ 78,611,350*
Annualized Sample Project Capital Cost (1998 $)	*$ 567,079*	*$ 1,454,348*	*$ 6,064,175*	*$ 7,070,391*
Sample Project O&M (1998 $)	*$ 56,708*	*$ 145,435*	*$ 606,418*	*$ 707,039*
Costs				
Equivalent Project Throught (wet tons/year)	400000	400000	400000	400000
Equivalent Project Capital Cost (2007 $)	$ 6,010,298	$ 15,414,197	$ 64,272,388	$ 74,936,973
Equivalent Project O&M (2007 $)	$ 54,057	$ 138,637	$ 578,073	$ 673,991
Discounted Cash Flow Factor (15 @ 4%)	11.118	11.118	11.118	11.118
DCF O&M Costs (2007 $)	$ 601,009	$ 1,541,366	$ 6,427,015	$ 7,493,436
Emissions				
VOC (tpy)	624	624	624	624
Ammonia (tpy)	562	562	562	562
VOC Capture Efficiency	n/a	25%	95%	95%
VOC Destruction Efficiency	n/a	90%	95%	90%
VOC reductions (tpy)	n/a	140.4	563.16	533.52
Ammonia Capture Efficiency	n/a	19%	95%	95%
Ammonia Destruction Efficiency	n/a	75%	95%	75%
Ammonia reductions (tpy)	n/a	80.1	507.2	400.4
Cost Effectiveness				
Average				
VOC Cost Effectiveness ($/ton)	n/a	$ 4,912	$ 7,587	$ 9,474
Ammonia Cost Effectiveness ($/ton)	n/a	$ 8,611	$ 8,424	$ 12,623
Incremental				
VOC Cost Effectiveness ($/ton)	n/a	n/a	$ 8,475	$ (26,386)
Ammonia Cost Effectiveness ($/ton)	n/a	n/a	$ 8,389	$ (7,324)

Notes:
Sample windrow project is Bio-gro
Real interest rate of 4% at 15 years used for Discounted Cash Flow Factor (SCAQMD method)
Annual inflation rate of 3% used to adjust to current year (2007 dollars)
Capital cost annualized by multiplying by CRF based on 15 years at 4%

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Appendix "B"
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